

Appendix B

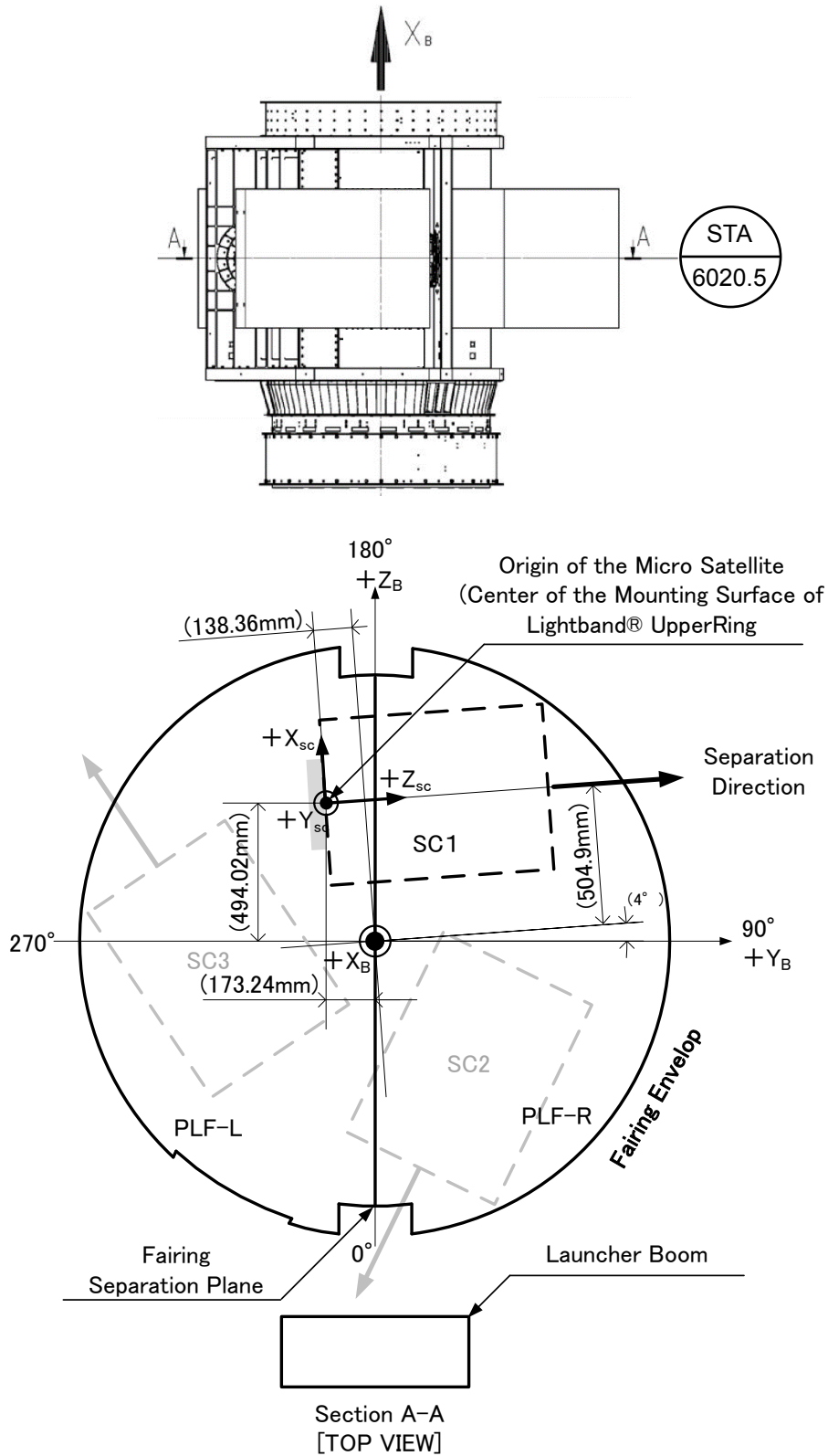
Lightband® Interface

This document describes Lightband® interface.



B1. Mount Position

The coordinate systems of LV and Micro satellites are shown in Figure B1-1.



(The coordinates of other 2 satellites, SC2 and SC3, are arranged 120 [deg] apart.)

Figure B1-1 Coordinate Systems of LV (B) and Micro Satellite (SC1)

B2. PL Usable Volume

PL usable volume is defined in Section 4.1.1.

The usable volume for a Micro satellite is shown in Figure B2-1.

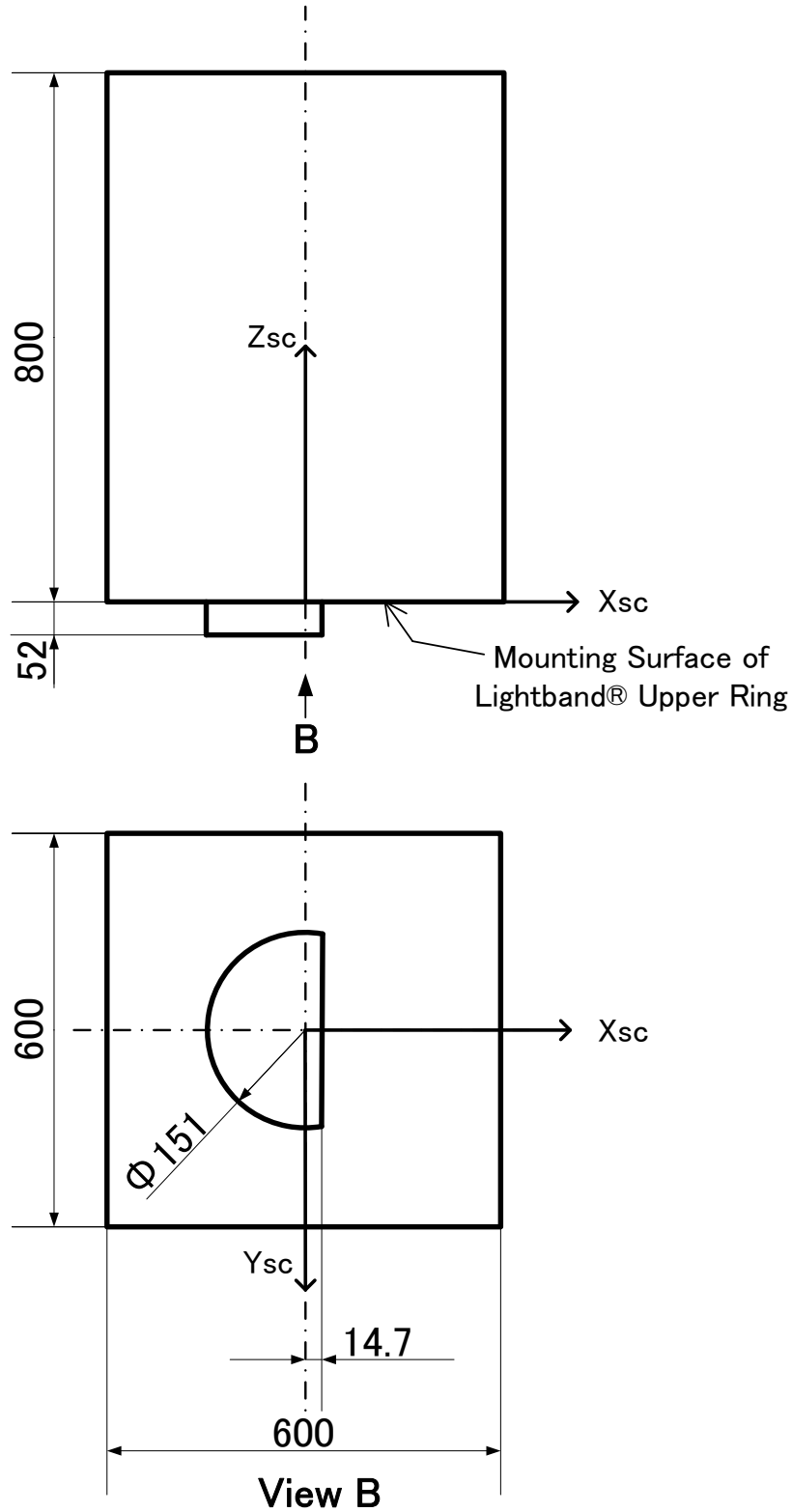


Figure B2-1 Usable Volume for Micro Satellite

B3. Mechanical Interface

(1) Details of Lightband®

The connection/separation system for Micro satellites is Lightband® (8 inch MLB8.000-12) manufactured by Planetary Systems Corporation.

The interface dimensions of the Lightband® are shown in Figure B3-1.

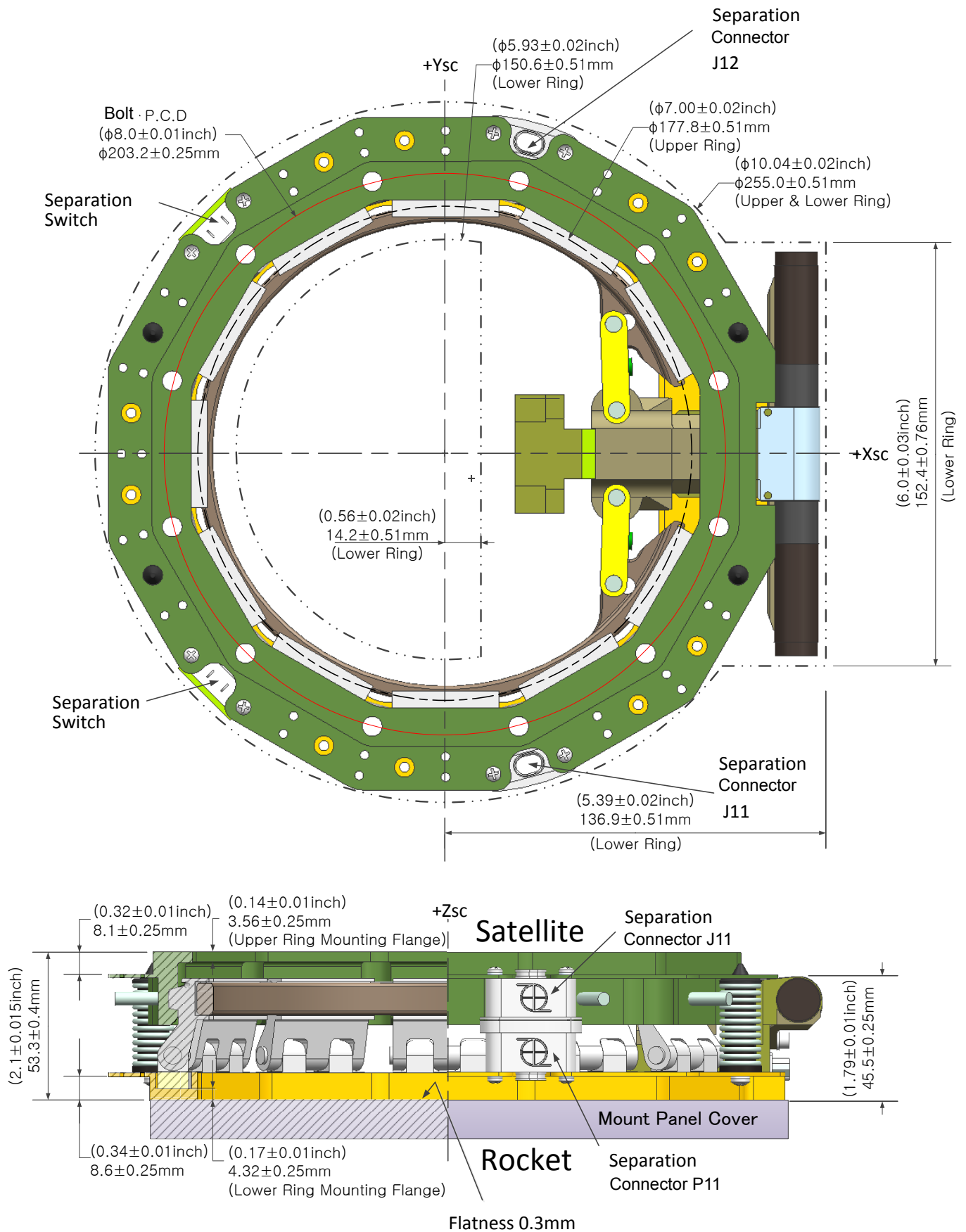
The interface on Micro satellite rear frame surface with the Lightband® upper ring is shown in Figure B3-2.

Notes:

For any related information not provided in this document, refer to 2000785F MkII MLB User Manual (Lightband® User Manual).

If there is any discrepancy between this document and Lightband® User Manual, this document will prevail.

If you are uncertain or doubtful about any description in this document, contact your Program Director.



※The number and arrangement of separation springs are for reference. Actual ones are defined in ICD of each micro satellite.

Figure B3-1 (1/2) 8 inch Lightband® Interface Dimensions (connected)

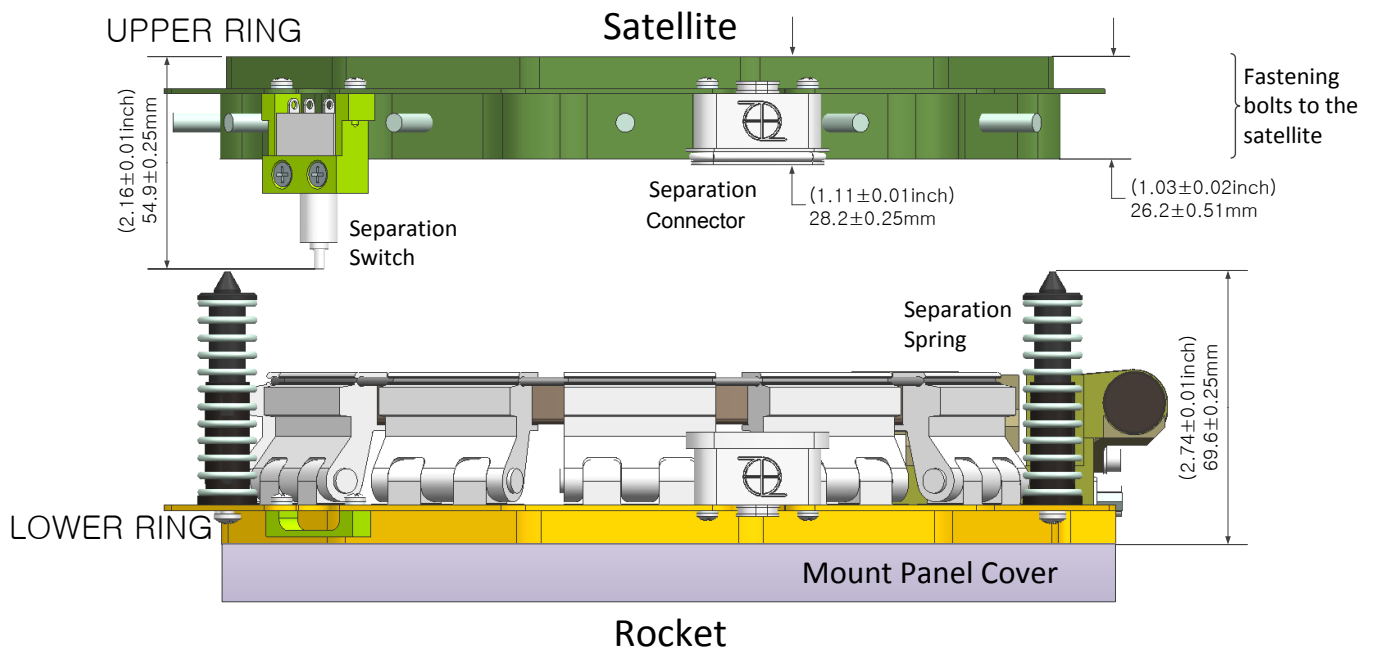


Figure B3-1 (2/2) 8 inch Lightband® Interface Dimensions (separated)

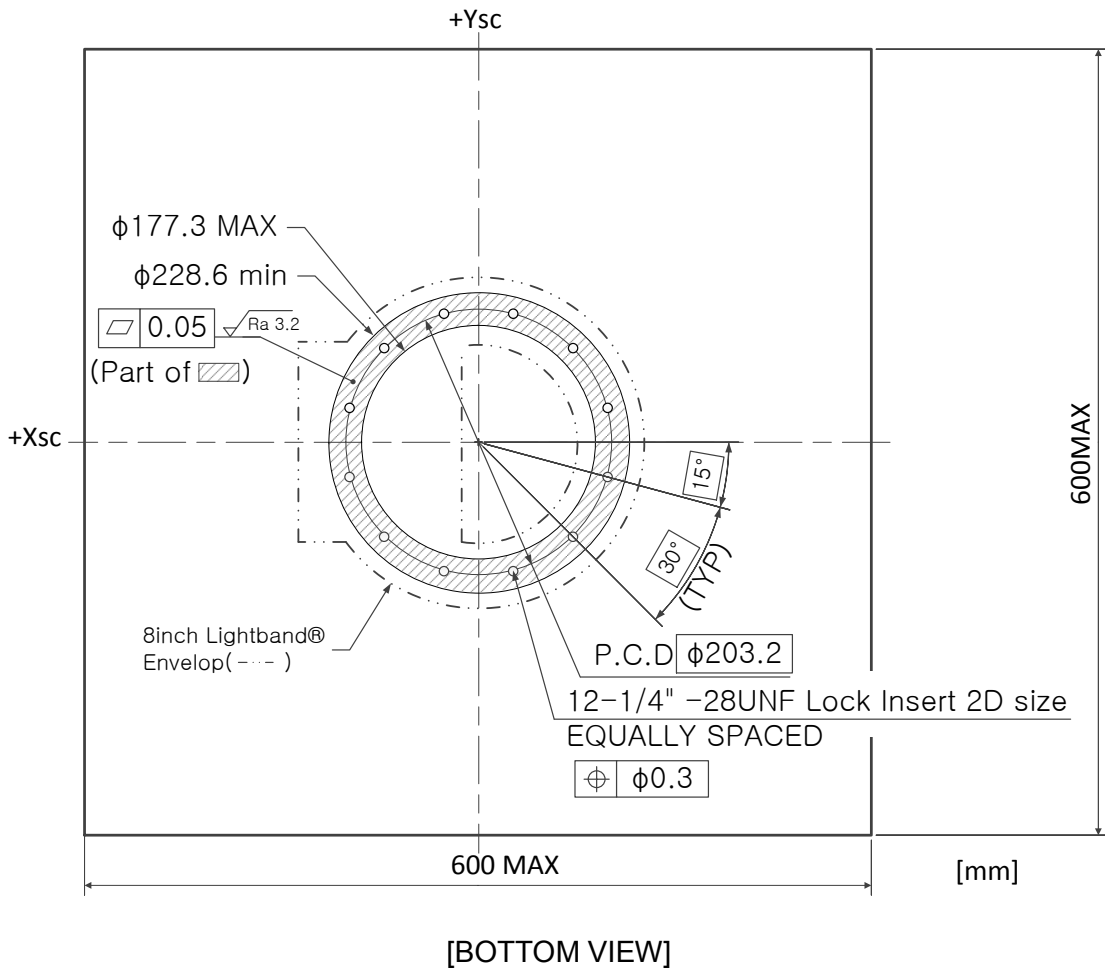


Figure B3-2 Interface on Micro satellite rear frame surface with Lightband® upper ring

(2) Interface Demarcation Point

The interface demarcation point is shown in Figure B3-3.

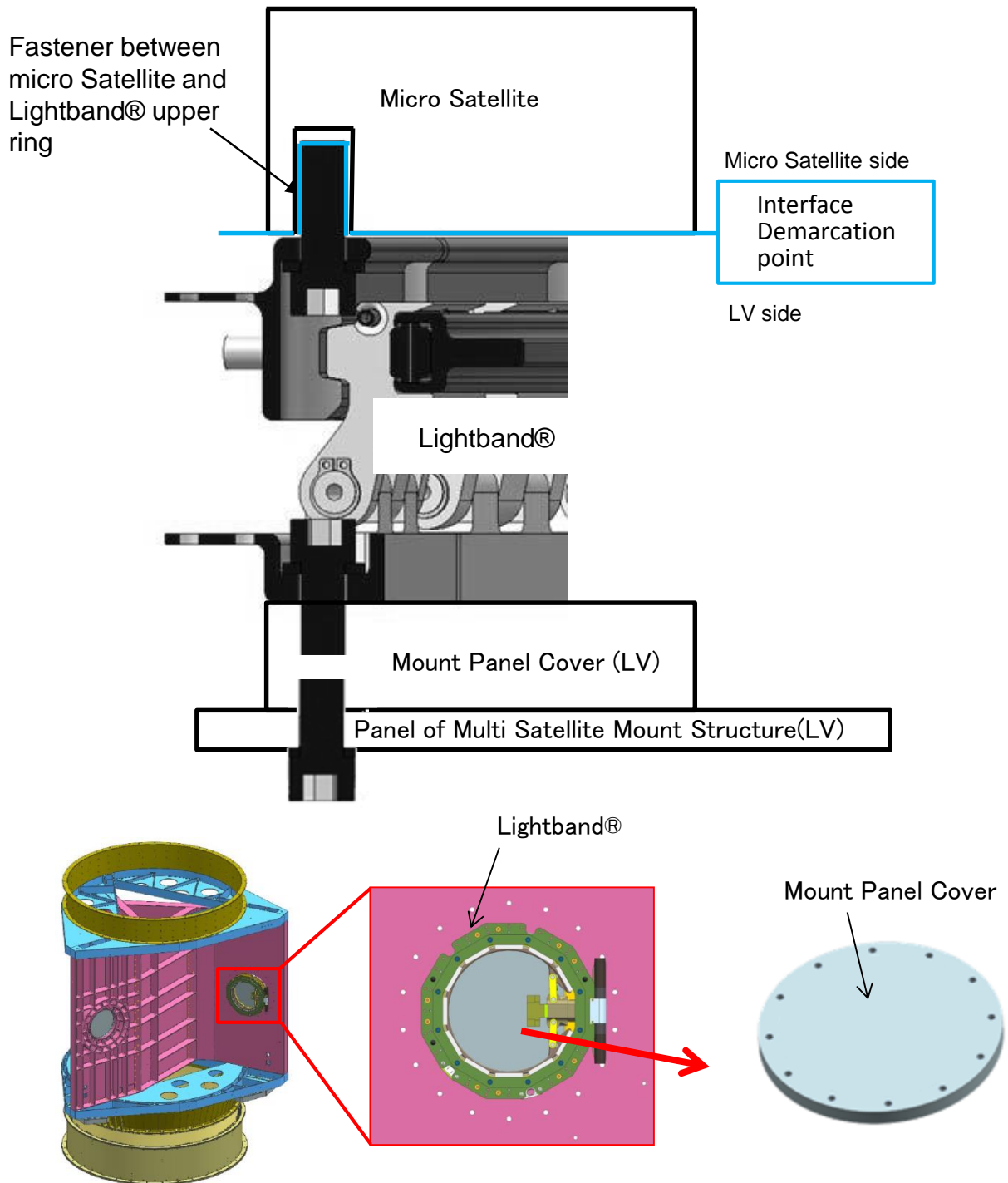


Figure B3-3 Interface Demarcation Point

(3) Rear Frame of Micro Satellite

The rear frame of a Micro satellite is not subject to direct load generated by the tip of each separation spring because the load is mitigated by the Lightband® upper ring.

(4) Material for Mating Section

The standard materials for the mating section are shown in Table B3-1.

Table B3-1 Materials for Mating Section

	PL side	LV side
Material	Defined in ICD	Aluminum Alloy

(5) Coating on Mating Section

The standard coatings on the mating section are shown in Table B3-2.

Table B3-2 Coatings on Mating Section

	PL side	LV side
Contact Surface	Defined in ICD	Anodic oxidation coating MLI-A-8625, TYPEIII, Class1
Other Surfaces	Defined in ICD	Anodic oxidation coating MLI-A-8625, TYPEIII, Class1 Electroless nickel plating AMS-B26074, Class4, GradeB Chemical conversion coating MIL-C-5541, Class3 etc.

(6) Mass of parts of the separation system remaining on PL side

The mass of parts of the separation system remaining on Micro satellite side after separation is shown in Table B3-3.

Table B3-3 Typical mass of parts of separation system remaining on Micro satellite side after separation

		Nominal	Notes
Mass [kg]		0.511	-
Center of Gravity [mm]	X_{sc}	-6.01	Coordinate System is shown in Figure B2-1.
	Y_{sc}	-0.03	
	Z_{sc}	-9.84	

Note: Values are for standard configuration of parts. The details of remaining parts of separation connectors and separation switches are shown in Section B3. (9) and Section B3. (10), respectively.

(7) Mechanical interface between Lightband® upper ring and Micro satellite rear frame

Typical mechanical interface between a Lightband® upper ring and a Micro satellite rear frame is shown in Table B3-4.

Interface dimensions in the mating section of a Lightband® upper ring and a Micro satellite rear frame are shown in Figure B3-4.

Customer shall verify the strength of the mating section of its Micro satellite rear frame.

The strength of each fastener is shown in Table B3-5. The allowable load of the fastener and reference value of the maximum axial force at the highest tightening torque as seen in Table B3-4 are shown in Table B3-5.

Table B3-4 Typical mechanical interface between Lightband® upper ring and Micro satellite rear frame

Number of Fasteners	12
Fastener Part Number	NAS1351N4-12 (L = 19.05 mm)
Washer Part Number	NAS620B416 (t = 1.6 mm)
Running Torque	0.4 to 3.3 N·m
	Customer, before shipping, shall confirm that the bolt holes on its satellite rear frame meet the above running torque value.
	LSP, before mating, will confirm that the bolt holes meet the above running torque value, and then apply combined forces of running torque and tightening torque to tighten fasteners.
Tightening Torque	8.7 to 10.1 N·m
Insert	Length: 2D
	Lock type (Lock insert)
	Coating: No Coating
Procurement	Fasteners & washers: LV
	Inserts: PL

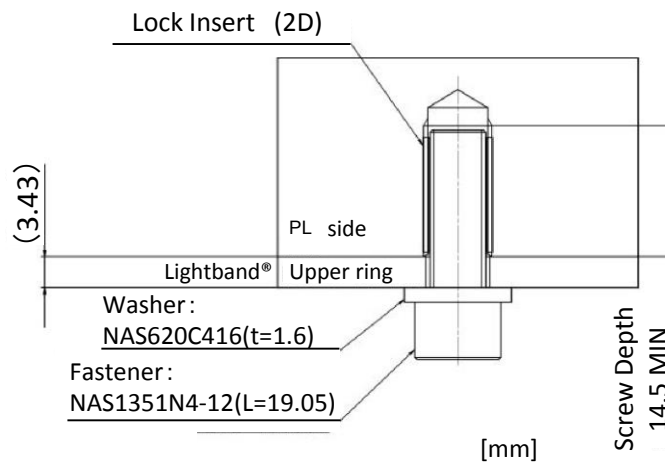


Figure B3-4 Interface Dimensions of Mating Section of Lightband® upper ring and Micro satellite rear frame

Table B3-5 Allowable load of fastener and reference value of maximum axial force

		Unit	Value	Notes	
(A)	Initial Axial Force	N	8,494	Tightening Torque 10.1 [Nm]	
(B)	Heat Load	N	156.5	Assumed ambient temperature range: 14 to 26°C Increased heat load when the ambient temperature rises to 26°C from 14°C (fastener is tightened at 14°C). If you need to extend the range, extrapolate linearly (13 N/°C).	
(C)	Internal Coefficient	—	0.53		
(D)	External Force (Assumed)	Yield	N	8,363	This value is stated in Lightband® User Manual.
(E)		Ultimate	N	10,453	
-	Max Axial Force	Yield	N	13,104	= A+B+C x E
-		Ultimate	N	14,218	= A+B+C x E
-	Strength	Yield	N	19,416	NAS1351N4
-		Ultimate	N	25,889	NAS1351N4
-	Margin of Safety	Yield	—	0.48	
-		Ultimate	—	0.82	

(8) Separation Spring

The number and arrangement of separation springs will be defined in ICD.

Refer to Lightband® User Manual for the characteristics of separation springs.

(9) Separation Connector

Two separation connectors of Lightband® are used as standard.

The appearance of the separation connector is shown in Figure B3-5.

The specifications of the separation connector are shown in Table B3-6.

Refer to Chapter B4 for its electrical interface.



Figure B3-5 Separation Connector

Table B3-6 Specifications of Separation Connector

Number of connectors	2
Connector Arrangement	See Figure B3-1.
Pin Arrangement	See Chapter B4 (Electrical Interface).
Spring characteristic	See Lightband® User Manual.
Procurement	By LV

(10) Separation Switch

Two separation switches of Lightband® are used as standard.

The appearance of the separation switch is shown in Figure B3-6.

The specifications of the separation switch are shown in Table B3-7.

If 3 switches are needed, contact your Program Director.

Refer to Chapter B4 for its electrical interface.



Figure B3-6 Separation Switch

Table B3-7 Specifications of Separation Switch

Number of switch	2
Switch Arrangement	See Figure B3-1.
Spring characteristic	See Lightband® User Manual.
Procurement	By LV

B4. Electrical Interface

B4. 1 Separation connector of Lightband®

Two separation connectors of Lightband® are used as standard. See Section B3 (9) for its appearance. The electrical interface is shown in Table B4-1.

LV uses some pins on each separation connector as shown in Table B4-1 with short wires connected for detecting separation status. Pins other than those used by LV are available for Customer.

Customer may use these separation connectors as separation switches; however, it should be noted that the connectors have the normally open contact and that the status is open after separation. In addition, LV does not guarantee any Micro satellite the use of the separation connectors after separation in its orbit.

Electrical connections between a Micro satellite and LV or launch site facilities are not provided via umbilical line as standard.

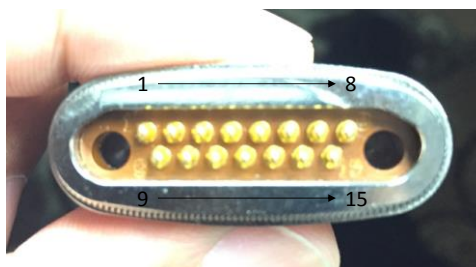
Customer can access its PL for charging its battery or other operations before mating with Lightband® or before encapsulation into PLF.

The separation connectors serve as bonding pass between Lightband® upper ring and its lower ring.

Table B4-1 Electrical Interface of Separation Connector

Number of connectors	2
Connector Location	See Figure B3-1.
Pin Assignment	See Figure B4-1.
Pins used by LV	J11: pin No. 4, 11, 5, 13 J12: pin No. 5, 13
Procurement	By LV

Separation connector
(Upper)
J11,J12



Separation connector
(Lower)
P11,P12

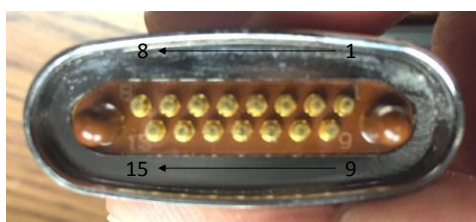


Figure B4-1 Pin Assignment

B4. 2 Separation switch

(1) Separation Switch of Lightband®

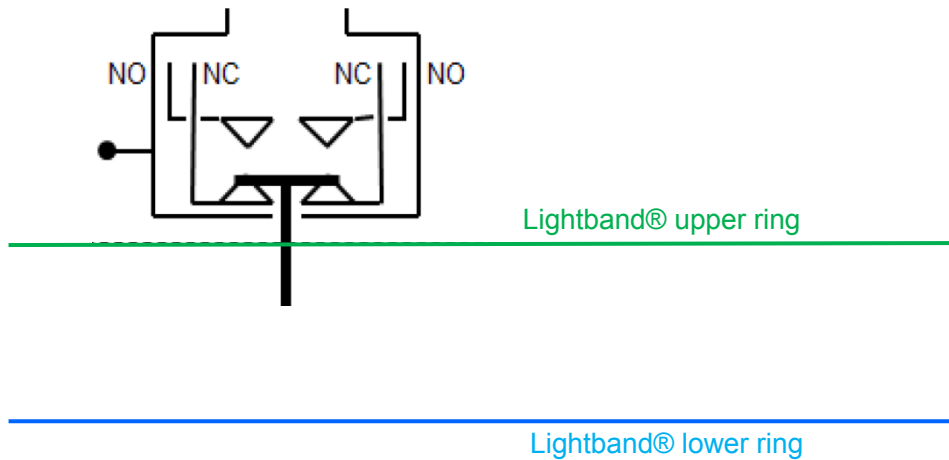
Two separation switches of Lightband® are used as standard. If 3 switches are needed, contact your Program Director. See Section B3 (10) for its appearance.

The electrical interface is shown in Table B4-2.

LV does not guarantee any Micro satellite the use of the separation switches in its orbit.

Table B4-2 Electrical interface of Separation Switch

Number of switches	2
Switch Location	See Figure B3-1.
Switch Type	SPDT (Single-Pole Double-Throw)
Circuit Diagram	See Figure B4-2.
Procurement	By LV



* Separated state

Figure B4-2 Circuit Diagram of Separation Switch

(2) Separation Switch provided by PL

PL can install separation switches chosen and provided by itself, instead of separation switches of Lightband®, on the Lightband® upper ring.

After PL connected with the Lightband, separation switches are inaccessible, and the dimensions around them cannot be measured.

Strokes of the separation switches are defined in ICD because their movement in height direction are affected by reaction force of the separation switches. Customer shall inform Program Director of the reaction force.

The separation switches of Lightband® are recommended if Customer is to require high accuracy of PL rate in separation because the separation springs are arranged based on reaction force of the separation switches of Lightband®.

Since separation switches provided by PL can greatly increase PL rate in separation, Customer should consult Program Director for their use.

B4. 3 Bonding

Bonding is also described in Section 4.4.6.

PL is electrically connected with Lightband® upper ring via fasteners and inserts (Figure B4-3).

Customer shall confirm in advance that the resistance between two points as shown below meets the required value described in Section 4.4.6.

- (1) A head or washer of each fastener fixed on Lightband® upper ring
- (2) PL main structure

Bonding jumpers are also acceptable for ensuring the electrical connectivity .

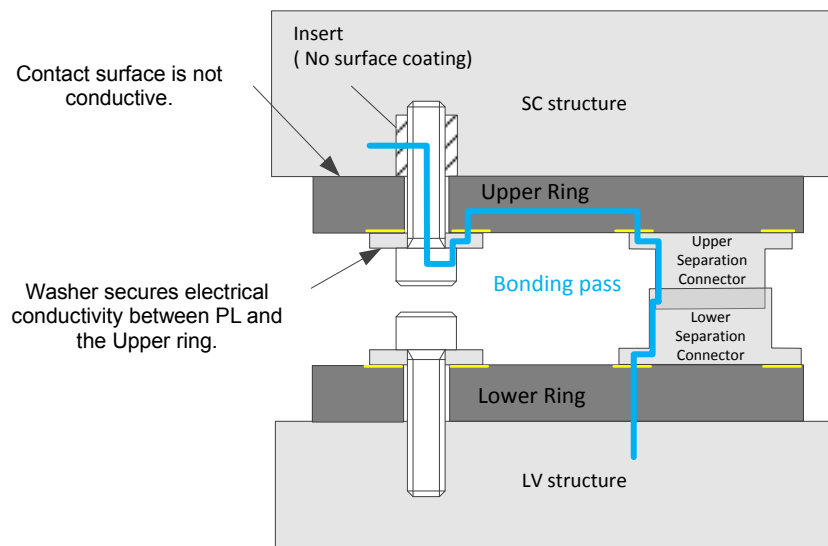


Figure B4-3 Bonding pass